

CASSINI ENVIRONMENTAL TEST AND ANALYSIS PROGRAM SUMMARY

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Abstract

The Cassini interplanetary spacecraft was launched on a Titan IV/Centaur expendable launch vehicle in October 1997 on a mission to the planet Saturn and its major moon, Titan. Interplanetary cruise will be nearly seven years with the orbital tour four years in duration. This paper presents an overview of the Cassini Project's environmental test and analysis program during the spacecraft development phase (October 1989 to launch in October 1997). After describing the top-level objectives of the program, summaries of the approach, requirement, and margins are presented. Assembly and system level environmental tests that were performed include dynamic, thermal, electromagnetic compatibility (EMC), and magnetic tests. Analysis was used to verify that the environmental requirements of radiation, micrometeoroids, and single event effects have been satisfied. The environmental program implemented on Cassini satisfied the spirit and intent of the requirements imposed by the Project during the spacecraft's development. The lessons learned from planning and implementing the Cassini environmental program are discussed.

Author's Biographical Sketches

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Alan Hoffman has a Bachelor of Arts degree in Physics, a Master of Science degree in Mathematics and 35 years of experience in analyzing and specifying environmental requirements and associated environmental disciplines at the Jet Propulsion Laboratory, where he is a Member of the Engineering Staff- Principal in Office 505, Reliability Engineering. He has authored/coauthored 28 papers in his discipline and is recognized as an authority regarding environmental test and analysis requirements and effectiveness and environmental retest guidelines. He served as the Galileo Environmental Requirements Engineer for five years. His efforts contributed to the successful, launch cruise, and orbital tour of Jupiter by the Galileo spacecraft. He was the Cassini Environmental Requirements Engineer for seven years and developed an international reputation for the explanation, interpretation, and clarification of spaceflight environmental requirements. He has received a NASA Exceptional Service Medal for his contributions to Galileo and NASA Group Achievement Awards for Ranger VII, Mariner 9, Viking, Voyager, and Galileo flight projects.

John Forgrave graduated from UCLA with a Bachelor of Science degree in Mechanical Engineering in 1977. He is a Registered Mechanical Engineer in the State of California. Mr. Forgrave has been involved in vibration and fatigue analysis throughout his career. At Garrett AiResearch he participated in the development of large gas centrifuges for the enrichment of uranium. As a private consultant he performed vibration and fatigue analysis on various types of machinery including wind turbines. At Marconi Dynamics he performed acoustic and random vibration analysis and testing on missile systems. At the Jet Propulsion Laboratory Mr. Forgrave performs sinusoidal, random and acoustic vibration analysis and testing to insure the safe launch of interplanetary spacecraft.